or (ii) a partially solid, partially [liquid] molten alloy having crystal nuclei at a temperature not lower than a molding temperature [is fed into an insulated vessel having a heat insulating effect, held in],

B1 cont.

(b) maintaining said molten alloy in said insulated vessel for a period from 5 seconds to 60 minutes [as it is cooled] and cooling said alloy to the molding temperature [where] to establish a specified liquid fraction [liquid is established], thereby crystallizing fine primary crystals in [the] an alloy solution thereof, and [the]

(c) feeding said alloy [is fed] into a forming mold[, where it is shaped] for shaping said alloy under pressure.

6 ~~2~~. **(Amended)** [A] The method according to claim 1, [wherein] which further comprises prior to step (a), superheating the alloy to a temperature less than 300°C above the liquidus temperature; and generating the crystal nuclei [are generated] by contacting the molten alloy with a surface of a jig at a temperature lower than the melting point of said alloy [which has been held superheated to less than 300°C above the liquidus temperature].

7 ~~3~~. **(Amended)** [A] The method according to claim 6 ~~2~~, wherein the jig [with which the melt is to be contacted] is selected from the group consisting of (i) a metallic jig [or], (ii) a

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nonmetallic jig, [or] (iii) a metallic jig having a surface thereof coated with a nonmetallic material [or], (iv) a metallic jig having a surface thereof coated with a semiconductor, [or] (v) a metallic jig composited with a nonmetallic material [or] and (vi) a metallic jig composited with a semiconductor[, with]; said jig being adapted to be coolable from [either] the inside or outside thereof.

B' cont.

8 ~~4~~. **(Amended)** [A] The method according to claim [1 or] 6 ~~2~~, wherein the crystal nuclei are generated by applying vibrations to the molten alloy ~~molten metal~~ in contact with [either] the jig or the insulated vessel or both the jig and the insulated vessel.

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9 ~~5~~. **(Amended)** [A] The method according to claim 1 or 6 ~~2~~, wherein the alloy is an aluminum alloy of a composition within a maximum solubility limit or a hypoeutectic aluminum alloy of a composition at or above a maximum solubility limit.

12 ~~6~~. **(Amended)** [A] The method according to claim 1 or 6 ~~2~~, wherein the alloy is a mangesium alloy of a composition within a maximum solubility limit.

10 ~~7~~. **(Amended)** [A] The method according to claim 9 ~~5~~, wherein the aluminum alloy has added thereto 0.001% - 0.01% B and 0.005% - 0.3% Ti [added thereto].

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13 ~~8~~. **(Amended)** [A] The method according to claim 12 ~~6,~~ wherein the magnesium alloy has 0.005% - 0.1% Sr added thereto, or 0-01% - 1.5% Si and 0.005% - 0.1% Sr added thereto, or 0.05% - 0.30% Ca added thereto.

B1 cont.

11 ~~9~~. **(Amended)** [A] The method according to claim 10 ~~7,~~ wherein [a molten] the aluminum alloy [held] is superheated to a temperature of less than 100°C above the liquidus temperature and is then directly poured into the insulated vessel without using a jig.

14 ~~10~~. **(Amended)** [A] The method according to claim 13 ~~8,~~ wherein [a] the molten magnesium alloy [held] is superheated to a temperature of less than 100°C above the liquidus temperature and is then directly poured into the insulated vessel without using a jig.

21 ~~11~~. **(Amended)** A method of shaping a semisolid metal[, in which] comprising:

(a) maintaining a liquid alloy having crystal-nuclei that has been superheated [by] to a temperature of a degree (X °C) of less than 10°C above the liquidus line [is held] for said alloy in an insulated vessel for a period from 5 seconds to 60 minutes as [it] said alloy is cooled to a molding temperature where a specified liquid fraction [liquid] is established, such that the

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cooling from [the] an initial temperature at which said alloy is [held] maintained in said insulated vessel to [its] the liquidus temperature of said alloy is completed within a time shorter than the time Y [(in minutes)] calculated by the relation Y=10-X and [that] the period of cooling from said initial temperature to a temperature 5°C lower than said liquidus temperature is not longer than 15 minutes, whereby fine primary crystals are crystallized in [the] an alloy solution thereof, [which is then fed] and

B1 cont.

(b) feeding said alloy into a forming mold[, where it is shaped] for shaping said alloy under pressure.

B3 ~~12~~. **(Amended)** A method of shaping a semisolid metal[, in which] comprising:

(a) maintaining a partially solid, partially liquid alloy having crystal nuclei at a temperature not lower than a molding temperature [is held] within an insulated vessel for a period from 5 seconds to 60 minutes as [it] said alloy is cooled to the molding temperature where a specified liquid fraction [liquid] is established, such that the period of cooling from [the] an initial temperature at which said alloy is held in said insulated vessel to a temperature 5°C lower than [its] the liquidus temperature of said alloy is not longer than 15 minutes, whereby fine primary crystals are crystallized in [the] an alloy solution thereof, [which is then fed] and

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(b) feeding said alloy into a forming mold[, where it is shaped] for shaping said alloy under pressure.

23 ~~13~~. **(Amended)** [A] The method according to claim 21 ~~11~~ or 22 ~~12~~, wherein the crystal nuclei are generated by [holding] maintaining the ~~molten~~ alloy which is superheated to a temperature of less than 300°C above the liquidus temperature and contacting the [melt] molten alloy with a surface of a jig at a [lower] temperature lower than [its] the melting point of said alloy.

B1 cont'd

29 ~~14~~. **(Amended)** An apparatus for producing a semisolid forming metal having fine primary crystals dispersed in a liquid phase, which comprises:

(a) a nucleus generating section [that causes] containing a cooling jig, wherein when a molten metal [to contact a] contacts the cooling jig [to generate], crystal nuclei are generated in [the] a solution thereof, and

(b) a crystal generating section [having] including an insulated vessel in which [the] metal obtained [in] from said nucleus generating section is [held] maintained as it is cooled to a molding temperature [at which], wherein said metal is partially solid, partially liquid.

30 ~~15~~. **(Amended)** [An] The apparatus according to claim 29 ~~14~~, wherein the cooling jig in the nucleus generating section is

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[either] selected from the group consisting of (i) an inclined flat plate that has an internal channel for accommodating a cooling medium and [that] has a pair of weirs provided on [the] a top surface thereof parallel to the flow of the [melt] molten metal, [or] (ii) a cylindrical [or] tube and (iii) a semicylindrical tube.

B' cont.

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~~16.~~ **(Amended)** A method of shaping a semisolid metal[, in which a] comprising:

(a) maintaining a liquid alloy at a temperature not higher than the liquidus temperature of said liquid alloy, said liquid alloy being (i) a liquid alloy having crystal nuclei at a temperature not lower than the liquidus temperature, or (ii) a partially solid, partially liquid alloy having crystal nuclei at a temperature not lower than a molding temperature [is poured],

(b) pouring said liquid alloy from step (a) into a holding vessel [so that it is cooled] such that fine, nondendritic primary crystals are crystallized in an alloy solution thereof,

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said holding vessel being adapted to be heated or cooled ~~form~~ from the inside or outside thereof, said holding vessel being made of a material having a thermal conductivity of at least 1.0 kcal/hr·m·°C measured at room temperature,

(c) cooling said liquid alloy sufficiently rapid to provide a uniform temperature profile in said holding vessel, said cooling being carried out to a temperature at which a [fraction]

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solid fraction appropriate for shaping is established[, said vessel being adapted to be heatable or coolable from either inside or outside, being made of a material having a thermal conductivity of at least 1.0 kcal/hr·m·°C (at room temperature) and being held at a temperature not higher than the liquidus temperature of said alloy prior to its pouring, and in which said alloy is poured into said vessel in such a manner that fine, nondendritic primary crystals are crystallized in said alloy solution and that said alloy is cooled rapidly enough to be provided with a uniform temperature profile in said vessel, and said alloy, after being cooled, is fed] and

B1 cont.

(c) feeding said alloy into a forming mold[, where it is shaped] for shaping said alloy under pressure.

35 ~~17~~. **(Amended)** [A] The method according to claim 34 ~~16~~, wherein the [step of] cooling of said alloy is performed with [the] top and bottom portions of the vessel being heated [by] to a greater degree than [the] a middle portion of the vessel or [heat-retained with] heat is retained by the vessel, wherein the vessel is made with a heat-retaining material having a thermal conductivity of less than 1.0 kcal/hr·m·°C or [with either] by heating the top portion of the vessel or the bottom portion of the vessel [being heated], while the remainder [is heat-retained] of the vessel has heat retained therein.

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27 ~~18~~. **(Amended)** A method according to claim 24 ~~16~~, wherein the [step of] cooling of said alloy is performed with the holding vessel [holding said alloy] being accommodated [in] within an outer vessel [that is capable of accommodating said alloy holding vessel and] that has a smaller thermal conductivity than said holding vessel, or that has a thermal conductivity equal to or greater than that of said holding vessel and which has a higher initial temperature than said holding vessel, or [that is spaced from said holding vessel by] a gas-filled gap is disposed in a space between said holding vessel and said outer vessel, said cooling being carried out at a [sufficiently rapid] cooling rate sufficient to provide a uniform temperature profile through the alloy in said holding vessel at a time no later than the start of the shaping [step].

B1 cont.

28 ~~19~~. **(Amended)** In a method of managing the temperature of a semisolid metal slurry for use in molding equipment [in which] comprising pouring a molten metal containing a large number of crystal nuclei [is poured] into a vessel, where [it] the molten metal is cooled to produce a semisolid metal slurry containing both a solid and a liquid phase in specified amounts, [said slurry being] and subsequently [fed] feeding said slurry into a molding machine for shaping under pressure, the improvement wherein the vessel [for holding said molten metal] is temperature-managed such as to establish a preset desired

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temperature prior to the pouring of said molten metal and such that said molten metal is cooled at an intended rate after said molten metal is poured into said vessel.

B1 cont.

31 ~~20~~. **(Amended)** An apparatus for managing the temperature of a semisolid metal slurry to be used in molding equipment comprising:

(a) a vessel in which is poured a molten metal containing a large number of crystal nuclei [is poured] from a melt holding furnace [into a vessel], [where it is] said molten metal in the vessel is cooled to produce a semisolid metal slurry containing both a solid phase and a liquid phase in specified amounts and [in which] wherein said slurry is directly fed into a molding machine for shaping under pressure, [which apparatus comprising the vessel for comprising the vessel for holding said molten metal,] said vessel including (i) a vessel temperature control section for managing the temperature of said vessel, and (ii) a semisolid metal cooling section for managing the temperature of the [as-]poured molten metal such that [it] the molten metal is cooled at an intended rate, and

(b) a vessel transport mechanism comprising [basically] a robot for gripping, moving and transporting said vessel and a conveyor for carrying, moving and transporting said vessel.

32 ~~21~~. **(Amended)** [An] The apparatus according to claim 31 ~~20~~,

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wherein the vessel temperature control section comprises (i) a vessel cooling furnace for cooling the vessel at an ambient temperature not higher than a target temperature for the vessel and (ii) a vessel heat-retaining furnace for [holding] maintaining the vessel at an ambient temperature equal to said target temperature.

B1 cont

33 ~~22~~. **(Amended)** [An] The apparatus according to claim ~~20~~ 31, wherein the semisolid metal cooling section comprises (i) a semisolid metal [slowly] slow cooling furnace and (ii) a semisolid metal [slowly cooling] annealing furnace for managing the temperature [in itself] therein to be higher than the temperature in said semisolid metal cooling furnace.

34 ~~23~~. **(Amended)** [An] The apparatus according to claim ~~22~~ 33, wherein the [semisolid metal cooling furnace is such that the area around the] vessel is carried on [the] a conveyor device [moving to pass] which moves through said semisolid metal cooling furnace, said furnace is partitioned into [three regions, the] an upper region, a middle region and a lower [parts] region, by [means of] two pairs of heat insulating plates, one [pair consisting] of said pairs of the heat insulating plates comprises an upper right plate and an upper left plate and the other pair [consisting] of the heat insulating plates comprises a lower right plate and a lower left plate, [with] a heater [being] is

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installed in both said upper region and lower [parts] region for heating said [two parts] upper region and lower region at a [higher] temperature higher than hot air to be supplied to said [central part] middle region.

B1 cont.

35 ~~24~~. **(Amended)** [An] The apparatus according to claim ~~22~~ 33, [wherein] which further comprises a preheating furnace [is], said preheating furnace being installed [at a stage prior to] upstream of the semisolid metal cooling furnace [to ensure that both] for preheating (i) a plinth [having a lower thermal conductivity than said vessel and] which carries said vessel before [it] said vessel is directed to said semisolid metal cooling furnace, said plinth having a lower thermal conductivity than said vessel and (ii) a lid for said vessel, said lid having a lower thermal conductivity than said vessel [and which is to be], said lid being placed to cover [it] said vessel after [it accommodates] said molten metal is poured into said vessel [are preheated by being moved to pass through said preheating furnace in advance].

36 ~~25~~. **(Amended)** [An] The apparatus according to claim ~~24~~ 35, wherein the semisolid metal cooling furnace is equipped with a control unit with which the temperature or the velocity of hot air to be supplied into said semisolid metal cooling furnace is controlled to vary with the lapse of time.

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~~26~~. **(Amended)** [An] The apparatus according to claim 33 ~~22,~~ wherein the semisolid metal cooling furnace comprises an array of housings each [accommodating] of which accommodate the vessel [as it] which contains the molten metal [and being], said furnace being equipped with an openable cover [and], hot air feed/exhaust pipes[, as well as] and a mechanism by which a receptacle for carrying said vessel is rotated about a vertical shaft.

B' cont.

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~~27~~. **(Amended)** [An] The apparatus according to claim 37 ~~26,~~ wherein [the] each housing [are each] is equipped with a vibrator for vibrating the receptacle.

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~~28~~. **(Amended)** [An] The apparatus according to claim 35 ~~24,~~ wherein the [semisolid metal cooling furnace for treating the molten metal as poured into a] vessel [having] has a thermal conductivity of at least 1.0 kcal/hr·m·°C; and the semisolid metal cooling furnace is supplied with hot air [having] at a temperature [in the range] from 150°C to 350°C for aluminum alloys and at a temperature from 200°C to 450°C for magnesium alloys.

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~~29~~. **(Amended)** [An] The apparatus according to claim 35 ~~24,~~ wherein the [semisolid metal cooling furnace for treating the molten metal as poured into a vessel having] vessel has a thermal conductivity of less than 1.0 kcal/hr·m·°C; and the semisolid

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metal cooling furnace is supplied with hot air [having] at a temperature [in the range] from 50°C to 200°C for aluminum alloys and at a temperature from 100°C to 250°C for magnesium alloys.

B1 D cont.

15 ~~30~~. **(Amended)** [A] The method according to claim 1 or ~~2~~ 6, wherein the vessel has a top surface and the molten alloy ~~metal~~ [as poured into the insulated vessel] is isolated from the ambient atmosphere by closing the top surface of said vessel with an insulating lid having a heat insulating effect as long as said molten metal is [held] maintained within said vessel until the molding temperature is reached.

16 ~~31~~. **(Amended)** [A] The method according to claim 1 or ~~2~~ 6, wherein the alloy is a zinc alloy.

17 ~~32~~. **(Amended)** [A] The method according to claim 1 or ~~2~~ 6, wherein the alloy is a hypereutectic Al-Si alloy having 0.005% - 0.03% P added thereto or a hypereutectic Al-Si alloy containing 0.005% - 0.03% P and having either 0.005% - 0.03% Sr or 0.001% - 0.01% Na or both added thereto.

18 ~~33~~. **(Amended)** [A] The method according to claim [i] 1 or ~~2~~ 6, wherein the alloy is a hypoeutectic Al-Mg alloy containing Mg in an amount not exceeding a maximum solubility limit and which has 0.3% - 2.5% Si added thereto.

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19 ~~34~~. **(Amended)** [A] The method according to claim 1 or 6 ~~2~~, wherein the shaping under pressure [forming] is accomplished [with] by the alloy being inserted into a container on an extruding machine.

B1 cont

20 ~~35~~. **(Amended)** [A] The method according to claim 19 ~~34~~, wherein the extruding machine is [of either] a horizontal extruder [or], a vertical [type] extruder, or [of such] a horizontal [type] extruder in which the container changes position from being vertical to horizontal before the shaping; and wherein the method of extrusion is [either] direct or indirect.

8 ~~36~~. **(Amended)** [A] The method according to claim 1, wherein the crystal nuclei are generated by a method in which two or more liquid alloys having different melting points that are held superheated to less than 50°C above the liquidus temperature are mixed [either] directly within the insulated vessel having a heat insulating effect or along a trough in a path into the insulated vessel, such that the temperature of the metal as mixed is [either] just above or below the liquidus temperature.

3 ~~37~~. **(Amended)** [A] The method according to claim 2 ~~36~~, wherein the two or more metals to be mixed are preliminarily contacted with respective jigs each having a cooling zone [such as] to produce metals of different melting points, that have crystal

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nuclei and which have attained temperatures just either above or below the liquidus temperature.

4 ~~38~~. **(Amended)** [A] The method according to claim 1, wherein [the top surface of] the semisolid metal [that is held within the insulated vessel and which is to be fed into the forming mold] is removed by [means of either] a metallic jig or a nonmetallic jig during a period from just after the pouring into said vessel, but before the molding temperature is reached and, thereafter, said semisolid metal is inserted into an injection sleeve.

B1 cont'

27 ~~39~~. **(Amended)** [A] The method according to claim 26 ~~18,~~ wherein the outer vessel is heated [either] from inside or outside thereof or by induction heating, [with such] said heating being performed only before or after the insertion of the holding vessel into the outer vessel or continued throughout the period not only before, but also after said insertion.

5 ~~40~~. **(Amended)** [A] The method according to claim [9] 1, wherein the [aluminum] alloy is [replaced by] a zinc alloy, said zinc alloy being superheated to a temperature above the liquidus temperature thereof and being directly poured into the insulated vessel without the use of a jig.

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